

REMARKS

Claims 47-52 have been added to the application so that claims 1-52 are now in the application. Claims 5, 8-10, 15 and 18-46 have been withdrawn from consideration.

The Examiner objected to the drawings on the basis that the notations "AF", "PL", "FL", "H.B." and "TB" were shown in the various figures but were not mentioned in the description. The description has been amended to include these notations. The Examiner also objected to the drawings on the basis that the numeral "28" in line 9 of page 5 is mentioned but is not shown in the drawings. The reference numeral "28" has been deleted from line 9, page 5 of the description.

As required by the Examiner, the title has been amended so as to clearly indicate the invention of the Applicant.

Changes to page 13 of the specification and claim 11 have been made as required by the Examiner.

Claims 1-4, 6, 7, 11-14, 16 and 17 were rejected under 35 USC 102(e) as being anticipated by Komuro. Amended claim 1 is distinguished over Komuro by reciting:

"the first and second free layer extensions having first and second top surfaces which are parallel with respect to the parallel surfaces of the AFM, pinned, free and tunnel junction layers;

first and second longitudinal bias layers formed on and in contact with the first and second top surfaces of the free layer extensions outside of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field."

This structure is shown in Fig. 3A wherein the first and second free layer extensions, which extend to the right and the left of the first and second vertical sides of the central portion of the free layer (FL), have first and second top surfaces facing upwardly which are parallel with respect to parallel surfaces of the AFM, pinned, free and tunnel junction layers 136, 134, 130 and 132 between the first and second side surfaces of the MTJ stack and first and second longitudinal bias layers 138 are formed on and in contact with the first and second top surfaces of the free layer extensions outside

of the active region for biasing the magnetic moment of the free layer (FL) in substantially a predetermined direction in the absence of an external magnetic field. In contrast, the longitudinal bias layers 7 in Fig. 5 of Komuro contact first and second side edges of the free layer 3 so as to be magnetostatically coupled instead of contacting the top surfaces of the free which are parallel to the parallel surfaces of the AFM, pinned, free and tunnel junction layers 4, 2, 3 and 1. In Applicant's invention the first and second longitudinal bias layers 138 in Fig. 3A are exchange coupled to top surfaces of the free layer extensions for a more effective longitudinal biasing of the central portion of the free layer (FL). This improved stabilization is enabled by direct contact of the longitudinal bias layers 138 with substantial portions (first and second top surfaces) of the HM layer 138 with the FM layer 130. This is discussed in Applicant's specification, page 12, lines 19-23 wherein it is stated:

"...MTJ sensor 120 permits excellent free layer stabilization because of the direct contact of a substantial portion of HM layer 138 with FM free layer 130 in end regions 124 and 126 without contact with any part of active region 122, thereby avoiding any loss of sensitivity from undesired shunting of sense current."

Claim 11, which contains similar limitations as claim 1, is considered to be patentable over Komuro for the same reasons as given in support for claim 1. Claims 2-4, 6 and 7, which are dependent upon claim 1, are considered to be patentable over the references for the same reasons as given in support for claim 1, and claims 12-14, 16 and 17, which are dependent upon claim 11, are considered to be patentable over Komuro for the same reasons as given in support for claim 11.

New claim 47 is considered to be patentable over Komuro for the same reasons as given in support for claim 1. Claim 47 is further distinguished over Komuro by reciting:

"each of the AFM, pinned, spacer and free layers having first and second side surfaces which are orthogonal with respect to the ABS with the first side surfaces of the AFM, pinned spacer and free layers being contiguous and the second side surfaces of the AFM, pinned, spacer and free layers being contiguous;

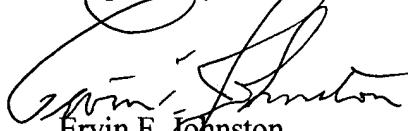
the free layer having laterally extending first and second side extensions which extend in opposite directions from the first and second side surfaces respectively of the free layer with each of the first and second side extensions having a top surface which is orthogonal with respect to the ABS and parallel with respect to said major thin film surfaces;"

This structure is shown in Fig. 3A wherein each of the AFM, pinned, spacer and free layers 136, 134, 132 and FL have contiguous first and second side surfaces and the free layer FL has first and second side extensions which extend in opposite directions from the first and second side surfaces respectively of the layer. As can be seen from Fig. 3A the free layer is notched on each side to provide the free layer with the first and second side surfaces and the first and second free layer extensions. This is a different and simpler construction than the sensor shown in Fig. 5 of Komuro where two masking steps are required to build the sensor, namely one for the free layer 3 and one for the layers 1, 2 and 4. In contrast, one masking step is employed in Fig. 3A in the active region of the sensor and ion milling is performed with slight overmilling into the free layer to ensure that all of the spacer layer in the active regions is removed. This is evident from page 12, lines 13 and 14 of the specification which state:

"...At this point, all layer materials outside the active region 122 are etched down to but not completely through FM free layer 130. . ."

Should the Examiner have any questions regarding this document he is respectfully requested to contact the undersigned.

Respectfully submitted,


Ervin F. Johnston
Reg. No. 20,190
Telephone: (619) 334-5883
Fax: (619) 448-1904